REMARKS

Claims 1, 2, and 5-21 are pending in this application. By this Amendment, claims 1, 2, and 5-16 have been amended, claims 3 and 4 have been canceled without prejudice to or disclaimer of the subject matter found therein, and claims 17-21 are added. The amendments to claims 2, 12, and 14-16 are to place the claims in the common U.S. format and to change the word "a" and "an" to "the" in the preamble. The amendments have no bearing on the patentable subject matter of claims 2, 12, and 14-16, as the amendments have no effect on how claims 2, 12, and 14-16 are interpreted. Support for newly-added claims 17 and 18 is found in paragraph [0112] of the specification. Support for newly-added claims 19-21 is found in paragraphs [0124] and [0125] of the specification and in Fig. 13 of the drawings. The amendment to claim 1 incorporates the features of canceled claims 3 and 4 and is further supported in paragraphs [0098] - [0107], paragraphs [0108] - [0111] and in Figs. 7 and 12. Claim 5 has been amended to reflect amended claim 1. Claims 6 and 10 have been amended into independent claims. The amendment to claim 6 incorporates the features of original claim 1, a portion of the features of original claim 8, and is further supported in paragraphs [0124] and [0125] and in Figs. 11 and 13. Claims 7, 8, and 9 have been amended to reflect amended claim 1. The amendment to claim 10 parallels the amendment to claim 6, and claims 11 and 13 have been amended to reflect the amendment to claim 10. Also the specification has been amended to correct minor informalities found therein. No new matter has been added.

In paragraph 3, on page 2 of the Office Action, claims 1-16 were rejected under 35 U.S.C. §103(a) over Toh et al. (Toh), (U.S. Patent No. 6,242,756 B1) in view of Baldwin et al. (Baldwin), (U.S. Patent No. 6,243,164 B1). The rejection is respectfully traversed.

Applicants' invention of claim 1 calls for an apparatus for detecting a coplanarity of a plurality of leads of an electronic component that laterally extend from a main body thereof, the main body having, in a plan view thereof, a shape including a plurality of straight side portions

from each of which the leads laterally extend, the apparatus comprising a holding device which holds the main body of the electronic component at an upper surface of the main body, wherein the holding device includes a rotating device which rotates the electronic component about an axis line thereof that perpendicularly passes through the upper surface of the main body; an image taking device which faces the electronic component held by the holding device and has an optical axis that is inclined by a predetermined angle relative to a plane containing a bottom surface of the main body such that in a direction from the image taking device toward the electronic component, the optical axis goes down in a direction from the upper surface to the bottom surface, wherein the rotating device rotates the electronic component, about the axis line thereof, to each of a plurality of angular positions at which a corresponding one of the plurality of side portions of the main body extends in a direction substantially perpendicular to the optical axis of the image taking device, at a position between the axis line of the electronic component and the image taking device, so that the image taking device takes an image of respective end portions of the leads extending from said one side portion of the main body; a background forming device which is provided on one of opposite sides of the electronic component that is opposite to the other side thereof on which the image taking device is provided, and which forms a background having an optical characteristic different from an optical characteristic of the leads; and an image processing device which processes the image of the respective end portions of the leads taken by the image taking device and thereby determines, as a first coplanarity, the coplanarity of the leads extending from said one side portion of the main body.

Applicant's invention of claim 6 calls for an apparatus for detecting a condition of an electronic component including a main body and a plurality of leads laterally extending from the main body, the apparatus comprising a holding device which holds the main body of the electronic component at an upper surface of the main body; a first image taking device which faces the electronic component held by the holding device and has an optical axis that is inclined

by a predetermined angle relative to a plane containing a bottom surface of the main body such that in a direction from the image taking device toward the electronic component, the optical axis goes down in a direction from the upper surface to the bottom surface, and which takes an image of respective end portions of the leads; a background forming device which is provided on one of opposite sides of the electronic component that is opposite to the other side thereof on which the image taking device is provided, and which forms a background having an optical characteristic different from an optical characteristic of the leads; a second image taking device which is different from the first image taking device and which takes an image of the bottom surface of the electronic component as viewed in a direction perpendicular to the bottom surface of the electronic component; an image-taking-device control portion which controls the first and second image taking devices to take the image of the respective end portions of the leads and the image of the bottom surface of the electronic component, respectively, at respective different timings; and an image processing device which comprises a first image processing portion which processes the image of the respective end portions of the leads taken by the first image taking device and thereby determines a coplanarity of the leads, and a second image processing portion which processes the image of the bottom surface of the electronic component taken by the second image taking device and thereby determines at least one positional error of the electronic component relative to the holding device in at least one direction parallel to the upper surface of the main body.

Applicant's invention of claim 10 calls for a system for mounting at least one electronic component on a circuit substrate, the electronic component including a main body and a plurality of leads laterally extending from the main body, the system comprising a holding device which holds the main body of the electronic component at an upper surface of the main body; a first image taking device which faces the electronic component held by the holding device and has an optical axis that is inclined by a predetermined angle relative to a plane containing a bottom

surface of the main body such that in a direction from the image taking device toward the electronic component, the optical axis goes down in a direction from the upper surface to the bottom surface, and which takes an image of respective end portions of the leads; a background forming device which is provided on one of opposite sides of the electronic component that is opposite to the other side thereof on which the image taking device is provided, and which forms a background having an optical characteristic different from an optical characteristic of the leads; a second image taking device which is different from the first image taking device and which takes an image of the bottom surface of the electronic component as viewed in a direction perpendicular to the bottom surface of the electronic component; an image-taking-device control portion which controls the first and second image taking devices to take the image of the respective end portions of the leads and the image of the bottom surface of the electronic component, respectively, at respective different timings; an image processing device including a first image processing portion which processes the image of the respective end portions of the leads taken by the first image taking device and thereby determines a coplanarity of the leads, and a second image processing portion which processes the image of the bottom surface of the electronic component taken by the second image taking device and thereby determines at least one positional error of the electronic component relative to the holding device in at least one direction parallel to the upper surface of the main body; a supplying device which supplies the electronic component to the holding device; a supporting device which supports the circuit substrate; a moving device which moves, while correcting the positional error of the electronic component detected by the image processing device, the holding device holding the electronic component, from the supplying device to the supporting device via the first and second image taking devices, and allows the holding device to mount the electronic component on the circuit substrate supported by the supporting device; and a coplanarity-utilizing control portion which controls the moving device while utilizing the coplanarity detected by the image processing

device. Neither Toh, Baldwin, nor the combination thereof, disclose or suggest the features as recited in claims 1, 6, and 10.

As admitted by the Examiner on page 3, Toh fails to disclose a background forming device which is provided on one of opposite sides of the electronic component that is opposite to the other side thereof on which the image taking device is provided, and which forms a background having an optical characteristic different from an optical characteristic of the leads. Toh also fails to disclose or suggest providing a rotating device that rotates Toh's pickup head 27. Toh discloses a system for determining a lead coplanarity, including a pickup head 27, such as a suction cup, for picking up an IC (integrated circuit) 100 having leads 101, light sources 25 (25A, 25B), reflectors 20, 21, a lens 23, and a video camera 24 (Figs. 4A and 4B). However, as shown in Fig. 8 of Toh, the video camera 24 takes, at once, an image of the entire IC 100 that includes all the four side portions from which the leads 101 laterally extend. Toh's pickup head 27 does not include a rotating device to rotate the IC 100 to take images of respective end portions of the leads because all four side portions are included at one time in one image.

Contrary to the Office Action's assertion, Baldwin also fails to disclose a holding device which includes a rotating device. In Fig. 2 of Baldwin, the system for determining a lead coplanarity includes a carrier 28, such as a vacuum pipette, for carrying an SMT package, i.e., an IC (integrated circuit) 10 having leads 14, light sources 55, and three image sensors 32, 42, 52. Baldwin only refers to a central axis of rotation 80 of the IC 10 to show a simplified isometric view of the IC 10, and to determine the position of the central axis 80 of the IC 10 (col. 7, lines 33-35 and lines 48-53). In other words, the central axis 80 is used as a reference for positioning the IC 10 on reference plane 50 (Fig. 5). Like Toh, Baldwin does not disclose or suggest providing a rotating device that rotates the carrier 28. The IC 10 as shown in Fig. 3 of Baldwin has two side portions from which the leads 14 laterally extend, and the system employs two image sensors 42, 52 that take respective collinear images of the two side portions of the IC

10 (Fig. 2). Alternatively, the image sensor 32 can take, at once, respective images of the two side portions of the IC 10 that are reflected by two reflectors 53 (Fig. 2A). Thus, like Toh, Baldwin's carriage 28 does not include a rotating device. The position of the central axis of rotation 80 of the IC 10 is used to define a virtual setting plane 60 (Fig. 4; col. 7, lines 33-47). Accordingly, there is no suggestion or motivation to make the alleged combination because neither the references disclose or suggest a rotating device, as recited in claim 1. Thus, the combination of Toh and Baldwin lacks the required suggestion under 35 U.S.C. §103(a).

Because neither of the applied references, nor the combination thereof, disclose or suggest all of the features recited in claim 1, the references cannot possibly suggest the subject matter of claims 2 and 5, which depend from claim 1, for the reasons discussed with respect to claim 1 and for the additional features recited therein. It is respectfully requested that the rejection be withdrawn. As to the §103 rejection of claims 3 and 4, the cancellation of claims 3 and 4 makes this rejection moot. As to the §103 rejection of claims 6-16, as discussed above, amended claims 6 and 10 are independent claims. Claims 7-9 depend from claim 6 and claims 11-16 depend from claim 10. Thus, claims 6-16 overcome the §103 rejection for the reasons discussed below.

As to the §103 rejection of claim 6, on page 5 of the Office Action, claim 6 was rejected for similar analysis as to claim 1. Also, on page 7 of the Office Action , the §103 rejection of claim 10 was based on a similar analysis to claim 1.

Amended claim 6 recites that the image taking device control portion controls a first and second image taking device as to take the image of the respected end portions of the leads and the image of the bottom surface of the electronic component, respectfully, <u>at respective different timings</u>. As discussed above, Toh only discloses that the single video camera 24 takes, at once, the image of the entire IC 100 (Fig. 8). Thus, Toh's invention does not suggest the subject matter of claim 6.

As to Baldwin, Baldwin fails to overcome the deficiencies as applied to Toh.

Baldwin discloses, in Fig. 2, a plurality of image sensors 32, 42, 52. However, Baldwin only discloses that the normal and collinear views (taken by the image sensors 32, 42, 52) are then combined to create a virtual three-dimensional representative of SMT package (IC) 10, particularly the positions of leads 14, to determine coplanarity of each lead 14 of SMT package (IC) 10 (col. 4, lines 36-40). Thus, Baldwin only teaches determining the coplanarity of the leads 14, but does not teach or suggest determining at least one positional error of the IC 10 relative to the carrier 28 in at least one direction parallel to an upper surface 38 of the IC 10, as recited in claim 6.

As to the §103 rejection of claim 10, amended claim 10 parallels the language of claim 6, and therefore, for the reason discussed above, neither Toh or Baldwin, nor the combination thereof, disclose the features as recited in claim 10.

Because neither of the applied references, nor the combination thereof, disclose or suggest all of the features of claims 6 and 10, the references cannot possibly suggest the subject matter of claims 7-9, which depend from claim 6 and the subject matter of claims 11-16, which depend from claim 10, for the reasons discussed with respect to claims 6 and 10 and for the additional features recited therein. It is respectfully requested that the rejection be withdrawn.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1, 2, and 5-21 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

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